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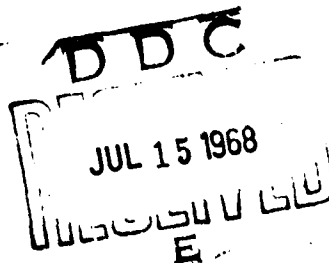
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MEDICAL-CLINICAL EXPERIENCES ON TUBERCULOSIS AS OCCUPATIONAL
DISEASE BY LABORATORY INFECTION*

(Following is the translation of an article by Dr. E. Jensen,
(Bremen-Oberneuland), published in the German language periodical
Tuberkulosearzt (Tuberculosis Doctor), vol. 13, (1959) pages
473-478. Translation performed by Constance L. Lust.)

According to the minutes of the meeting held on 26, Aug. 1952 on the extension of accidental insurance coverage for occupational illnesses, the conference dealt specifically with extension of insurance protection of infectious illnesses, which may be contracted during medical or scientific investigations. Tuberculosis as a result of infection in the lab was definitely considered an occupational illness. This may result from investigating the organism in the bacteriology chemical, or biology laboratory. A danger also exists when body fluids such as discharges, stomach juice, urine, bile and other specimens are analyzed. An investigator must be aware of the danger of infection and it should be required that he have detailed knowledge of the routes of infection of tuberculosis.

As a general rule airborne germs rank in first place as the mode of infection. In a distant second place by a factor of 10 to 1 are infections contracted through food-stuffs. From experimental work in the area of classical bacteriology we can deduce that the concept of a high danger of infection exists via particle-borne infective agents in the area of a tuberculosis illness. The attending medical personnel treating severely ill cases are the first exposed. This was first proposed by Flügge, and subsequently also expounded by his students. R. Koch subsequently pointed out the danger of infection via dust. This also can greatly expand the area of danger due to infection if the dust becomes airborne.

The intensity of infection of liquid drops and dust is dependent on several factors. Hippke showed that particles expelled from the tracheobronchioles 100-500 microns in diameter seldom travel more than 1-2 meters from the "cougher". Due to their relatively high specific gravity they quickly fall to the floor. On the other hand the very finely suspended, easily inhalable bacilli-containing dust particles which are in the low micron range can travel over extensive distances. This results in a greater danger of infection when these light infectious dust particles are breathed in. Often these dust particles do contain bacilli. Because the dust particles have this erroneous capacity to stay suspended TB infections may occur in rooms where TB patients are not found, but may have its source in infected clothing, wash, and equipment. The degree of contamination as well as the potential source of dust are critical in these cases. The main reservoirs of dust infections are the threads from material such as clothes, wash, and hand-

*Dedicated to Prof. Dr. R. Griesbach on the occasion of his 60th birthday.

kerchiefs. According to Lange less danger exists from smooth surfaces such as glass, stone and wood, and from dried excrement, and dried particles from coughing. The infective germs are not released so easily as dust from these sources.

Using the experience gained in several years (10) of bacteriological work as well as from more recent investigations on the danger of airborne infection the following fact evolves: Laboratory workers are exposed to a definite danger as long as their rooms are in the area of TB hospitals or sanatoria. On the basis of epidemiological considerations the terrain of TB-institutions is considered as contaminated. The degree of contamination depends on the number of severely ill patients, the discipline of the patients, and lastly also on the decontamination measures in effect. In this way the risk of infections passes from the hospital room, through the laboratories, living and working quarters of the hospital to the general population.

The primary tuberculin test gives information about a primary infection as well as certain information about the degree of allergy. Our repetitive tuberculin tests generally gave a positive Moro reaction corresponding to a threshold of 10^{-4} in the old tuberculin test (Alttuberculin-Reizschwelle). The manner in which those people (workers in a TB-hospital) that were continuously superinfected, responded was measured by using our percutaneous moro-salve. If after 24 hours the test was negative a further application of the salve was made at the same skin site, which resulted in a further positive test in 2.9-37.7% of the cases after the reaction ran its course. Comparing our hospital personnel to similar (age-wise) personnel of the neighboring nerve-clinic, they had a moro-sensitivity of 50.4% while our personnel had 78% and the latter almost reached the percutaneous tuberculin sensitivity of 85% which was the average for our TB patients. These results emphasize adequately the special place that personnel of TB-hospitals (or laboratories) have epidemiologically. This is reflected in the higher morbidity of the technicians and nurses of these institutions.

Medical technicians and assistants are, of course, included in those that are endangered in TB institutions, indirectly merely because they are in an area of the infection, and directly because they are actively associated in treating patients (drawing blood, etc.) and simultaneously work in the laboratories. This situation is particularly true in medium sized and smaller hospitals.

They perform similar duties as nurses, at least to a certain extent. Since their duties are frequently similar to those of nurses if an infection occurs in this occupational group most experts feel that it was contracted in the line of duty, since the danger of infection was recognized all along.

If TB-infection arise in assistants or technicians working in regular hospitals, where TB patients are not treated, stricter control measures

Kinds of cases	Age	Number	Moro single	Moro double	% change
TB-patients	15--60 yr.	891	687(77.1%)	760(85.3%)	10.6%
Personnel of TB-hospital	25--60	183	138(75.4%)	142(78.0%)	2.9%
Personnel of nerve clinics	25--60	333	122(36.6%)	168(50.4%)	37.7%

are required before it can be ascertained that the infection was occupationally contracted. This also applies for personnel in hygienic institutes, medical research labs and veterinary offices. It is possible to estimate using scientific instruments whether the possibility of infection via airborne drops or dust existed. This may have been due to the packaging of the materials. The material under study is usually suspended in liquid medium and is generally investigated after fixation. The starting of cultures for animal testing often requires similar procedures.

If thorough techniques are used in investigating the materials an infection should only occur if an accident takes place (such as spraying of liquids, injection). These are then classified as an occupational accident. It is often difficult to pin-point exactly the series of procedures which resulted in this kind of occupational infection. Investigators frequently are not aware when a danger existed during their experiments.

If an expert technician becomes infected and this leads to a period of lost time on the job for which he can claim losses from the accident insurance company, it is vital to know how the infection arose. It must be ascertained whether this infection resulted from "every day" (common) infections, or whether it was caused directly while on the job. The insurance company usually makes an intense, thorough investigation, the conclusion of which is written in letter form to employee and employer. It might be added; that after much argument and rebuttal the eventual finding usually is to the disadvantage of the employee in question.

In agreement with my own experience laboratory infections are really seen infrequently. The older literature has an occasional reference about it. These generally do not stand up under a critical examination of the facts. In part, some of these so-called lab-infections could be traced back to TB-infected coworkers, or rather contaminated working areas, as well as bad techniques.

Two cases from the recent literature may shed light on the whole topic under consideration. According to Ickert, a request for a claim was denied by an insurance agency for a young technician of a bacteriology laboratory who had contracted TB. It was thought, based on Ickert and

Simon's work, that unpacking of a carton containing sputum could not result in an accidental infection via aerosol. Rist and Simon reported that over a 14 year period 8 out of 12 lab assistants contracted TB. Actually, however, these people also served in the admission's window, and were directly exposed to patients with TB.

From my own experience, out of 554 cases of recognized TB I could only find 17 cases that could be classified as occupational infections in medical, technical assistants. This was reported as such to the insurance companies and health organizations. It merits pointing out, that in the case of experts lab-infection was not stated as a significant cause of accidental illness. Most of the evidence pointed to contact with patients who had TB.

The age of the 17 individuals who became occupationally infected was 18-29 years old, with the greatest number 21-25. This group became infected to the greatest extent. The duration of exposure to infection was between 4 months and 12 years. During the first year 5 individuals became infected; two the second year, and the rest (10) became ill within 10 years. The duration of exposure and age of which infection occurred in the lab-assistant correlated rather closely with the accident ratio of other hospital employees. The duration of exposure was generally similar in both of these groups. However, the nurses were probably exposed over a longer period when compared to lab personnel. From these considerations the danger of infection is then estimated. Thirteen individuals of the medical and nursing staff (treating staff) became ill before it was ascertained that they had a TB infection. Only four of the illnesses were detected by means of the routine chest x-ray procedure. The later the disease was detected the greater was the lost work-time in their respective occupations. All stages of TB infections were represented in this group.

It was obvious that the tuberculin test was neglected at the time of entry on employment as well as at the first time of exposure to the disease. In another case a BCG protective immunization was preceded by a negative tuberculin skin test. Taken as a whole the protective and defense measures in effect did not measure up to the expectations and recommendations of the insurance (union) for good health service and good health care. I repeatedly pointed this out to the "healing and care" personnel of hospitals in the preparation of the report on occupation-associated tuberculosis.

Summary: Tuberculosis as an Occupational Disease in Laboratory Assistants

→ Investigations have shown that technicians working in general hospitals or in laboratories of the Public Health Authorities are not particularly exposed to the risk of tuberculous infection provided due care is taken in the handling and disposing of the material. There are only very few cases in which proof can be established that the tuberculous disease was contracted in the course of work.-- Technical assistants working in tuberculosis hospital or chest clinics are considerably more exposed, not only because

of the type of work carried out by them, but also because of the constant contact with tuberculous patients. The risk attached to this kind of work is approximately the same as that of the medical and nursing staff in these establishments.

Literature

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Comment:

The above report was presented before the conference on "TB in the frame of the accident insurance" sponsored by the German Central Committee for the protection against TB on 22 June 1957. It was recommended, that the main points of this presentation should become familiar to all those endangered by a laboratory infection.